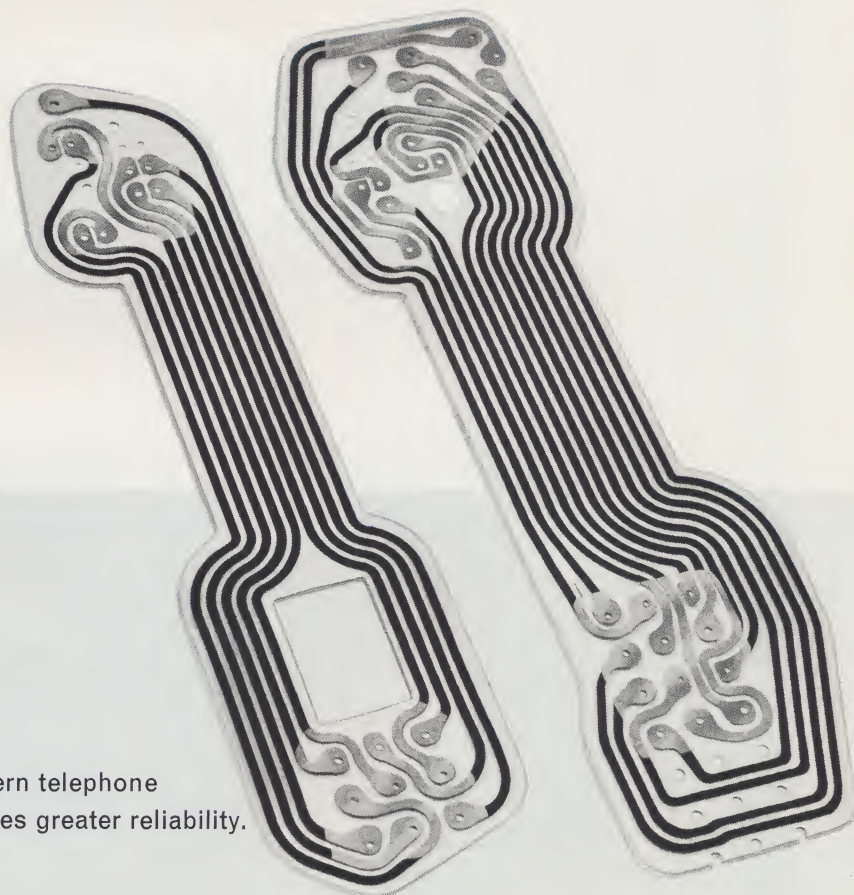




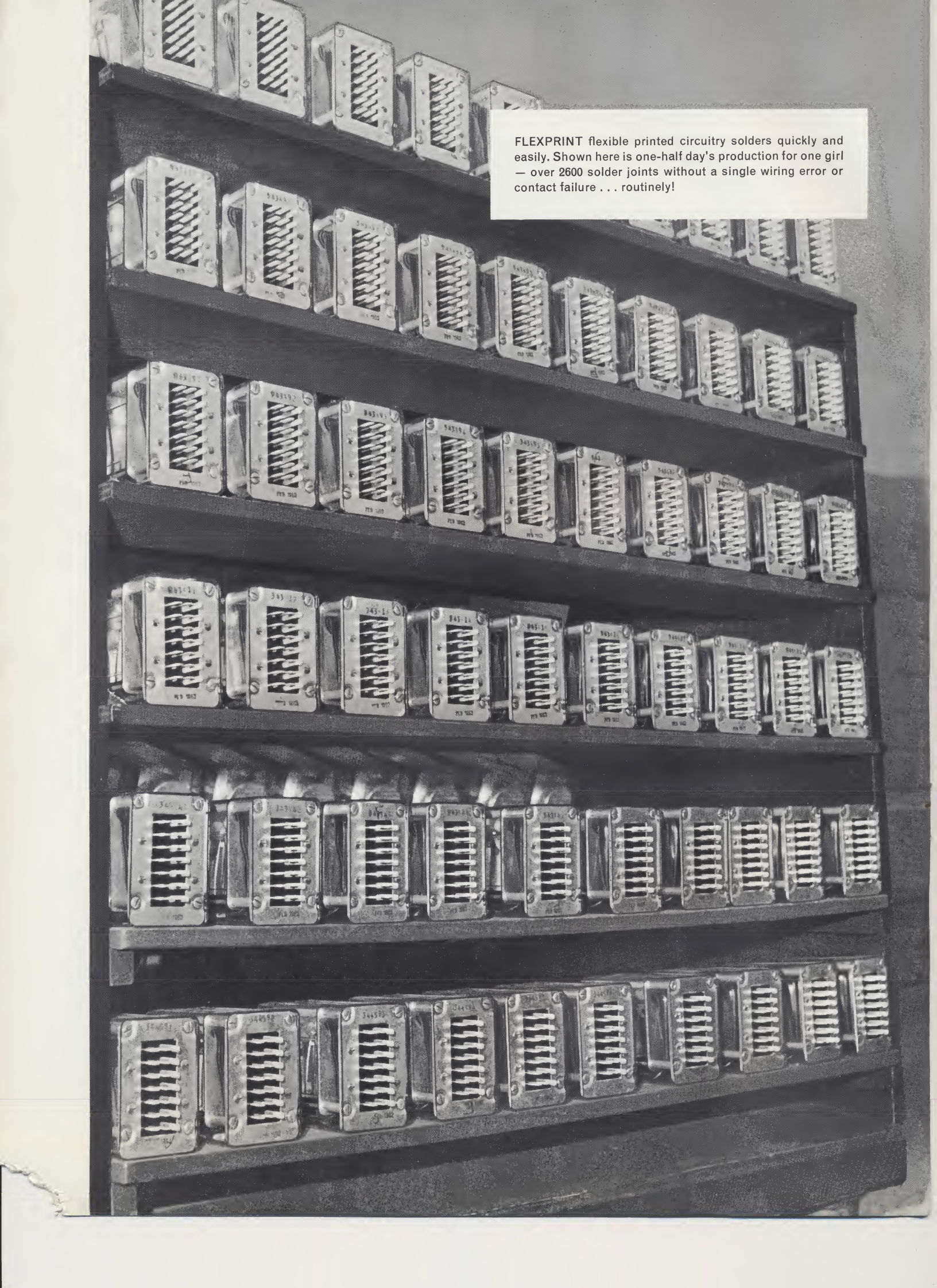
**CREATING
NEW DIRECTIONS
IN ELECTRONICS**

FLEXPRINT[®]

flexible printed circuitry



Two-layer FLEXPRINT harness, used in modern telephone equipment, saves time and money, and provides greater reliability.



FLEXPRINT flexible printed circuitry solders quickly and easily. Shown here is one-half day's production for one girl — over 2600 solder joints without a single wiring error or contact failure . . . routinely!

Cost-saving
FLEXPRINT
circuitry
increases reliability
of Telephone System
Interrupters
manufactured by
A.W. Haydon Company

In 1957, Western Electric asked the A. W. Haydon Company to develop a new Timer-Interrupter for the Bell System. After their engineering staffs had made a series of 50 prototypes, the form and function of this new unit were agreed upon and the production prototype was analyzed for cost estimating purposes.

The traditional round wire harness was let out for bids to a number of experienced wiring producers. The quotes received were not only very high, but they varied over 100%! While still searching for a solution, one of the engineers on the project saw Sanders FLEXPRINT circuitry at the IRE Show in March, 1958.

After investigating this then revolutionary technique, it was determined that FLEXPRINT harnesses would cost less than conventional wiring because of the large number of wires to be handled and the anticipated volume of production. It was also determined that with FLEXPRINT harnesses the size of the new Timer-Interrupter could be reduced. Furthermore, since the locations of conductors and terminations are consistently duplicated through a photo-etching process, FLEXPRINT harnesses provide greater reliability.

It was then decided to abandon the random wire harness and specify a FLEXPRINT harness for the new Timer-Interrupter. By August of 1958, designs for all components — including the FLEXPRINT harness — were finalized. Initial orders were delivered and production of the Timer-Interrupter was started late in 1958.

A few hundred thousand Timer-Interrupters have been manufactured to date. And today, design improvements and new manufacturing methods have cut the cost of the FLEXPRINT harness to substantially less than what it was originally!

Chances are FLEXPRINT circuitry can be used to cut the cost, size and weight of *your* equipment — and provide greater reliability, too. Remember — FLEXPRINT circuitry is custom-designed to meet *your* particular needs.



(A)



(B)

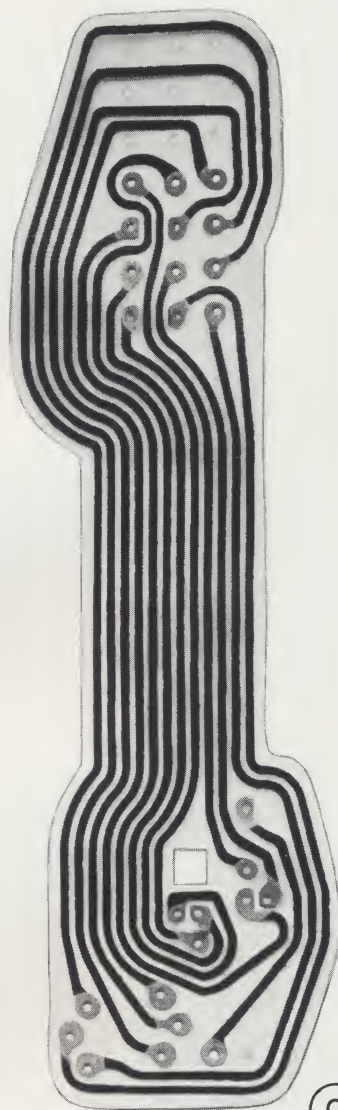
*Cost-saving
evolution in
FLEXPRINT
flexible circuitry
used in Haydon
Timer-Interrupter*

A. Hand-trimmed harness used in early design stage after ideas were first worked out on paper backed up with sheet rubber.

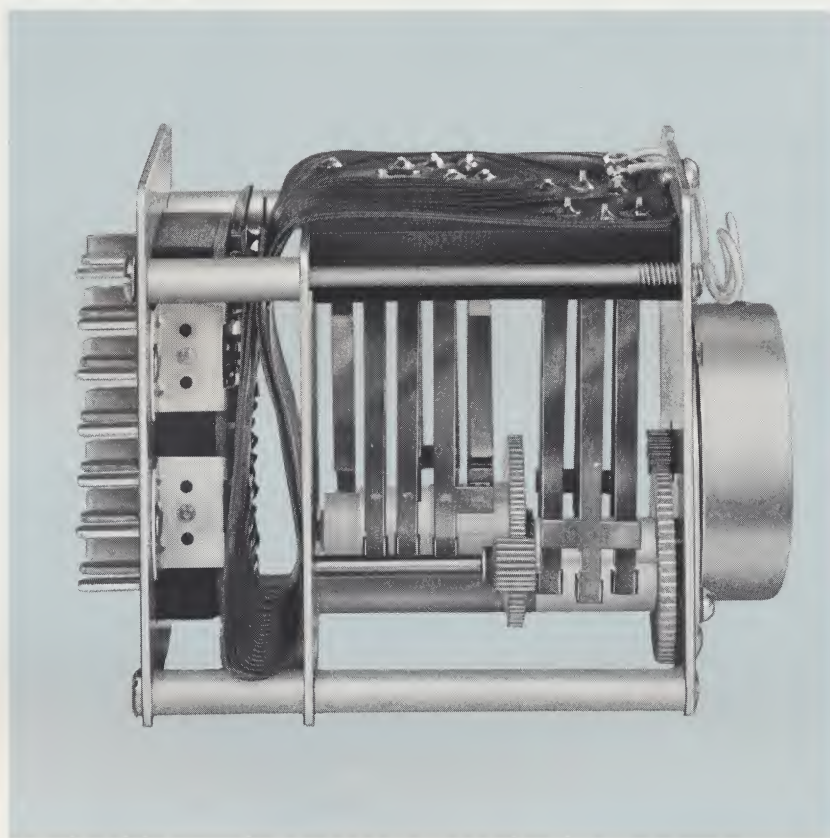
B. An early harness characterized by large solder pads.

C. Designed for mass production this revision was used between 1959 and 1961. (Note punched out solder areas close to terminals.)

D. Current cost-reducing design saves time in manufacture, uses less copper and plastic and speeds customer's assembly time.



(C)



A. W. Haydon Timer-Interrupter

The A. W. Haydon Timer-Interrupter is a repeat cycle timer which provides repetitive interruptions to the audio or visual devices that indicate busy, hold, ringing, and/or unanswered conditions. In field use, these Timer-Interrupters are plugged into larger assemblies installed in telephone systems either in the company's local offices or on the premises of customers buying Call Director (or other key telephone system) Service. Each unit serves up to 50 telephones performing the functions mentioned above.

The unit shown in this photograph was manufactured in November, 1959 and has been on forced life-test for over two years. It has required no maintenance and has performed perfectly in all respects in spite of a range of temperatures from $+40^{\circ}\text{F}$ to $+120^{\circ}\text{F}$. The forced life-test included electric currents of 200% of the operating maximum. Darkening of the vinyl base coat and cover coat are the only noticeable changes and apparently are not detrimental to the unit's performance.

Here's how FLEXPRINT circuitry speeds assembly, cuts cost of Haydon Timer-Interrupters



One girl feeds the sonic cleaner every 20 minutes. She can easily keep all operators supplied with cleaned and degreased units and handle an assembly job, too.



This photo shows the compact work space and simple equipment required: (1) solder jig with work in progress, (2) Mylar* shields to control heat transfer, (3) alcohol solvent and brush with which it's applied, and (4) pencil-type soldering iron.



Two terminal blocks are placed in their proper receptacles on the solder jig and the first layer of FLEXPRINT flexible printed circuitry is pressed quickly into position in one motion (see photo) on top of a Mylar apron.



Nine terminal pins at one end of the first layer are soldered in a running row in a few seconds using 60/40 wire solder. A Mylar shield is placed over the pins and the other end of the circuit is soldered into position.



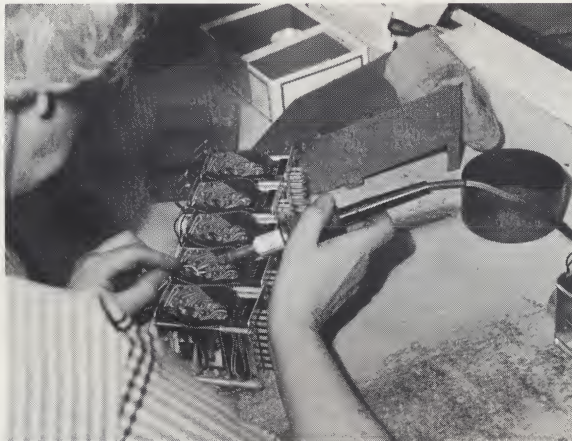
The second layer of FLEXPRINT circuitry is pressed down over the pins until it touches the Mylar shield. At this time soldering to the 12 remaining pins is done as before and this terminal block is completely connected.



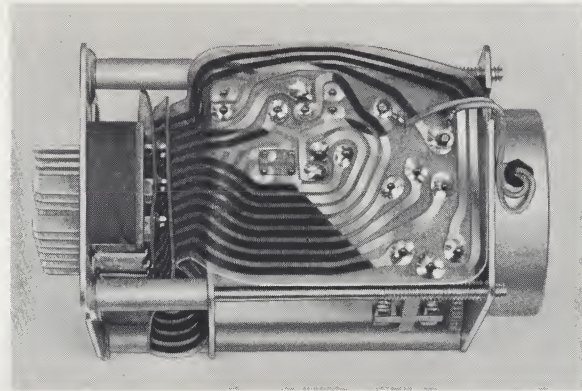
The bottom layer of the 2-layer FLEXPRINT harness and one end of the top cable have been soldered in place. At this point the operator is about to press down the remaining end of the top layer and solder it into position.



Soldering has now been completed and the FLEXPRINT harness and the two terminal assemblies are ready to be inserted into the final assembly. An easy 90° bend and an easy 180° bend are used to allow all soldering to be carried out on the same side of the harness, thereby reducing assembly costs.



Synchronous motor leads are soldered to two terminal pins protruding through the FLEXPRINT harness without disturbing the solder connection below. This is accomplished by using a quick heating and cooling cycle.



Bright, smooth fillets of solder are accomplished by: (1) clean wettable surfaces; (2) 60/40 eutectic solder; (3) W.W. rosin flux core; (4) a skillful operator; and (5) a short, vigorous massage with brush and solvent. Note how the solder-resisting areas of insulation act as dams to prevent bridging of circuits.



Each of these two 100-channel test recorders checks the switch timing on eight Timer-Interrupter units simultaneously. As the test is performed, the time intervals are recorded on a direct writing chart which is compared with the specified intervals marked on a clear plastic overlay master test pattern.

FLEXPRINT®

**flexible printed circuitry
makes a component
out of wiring**

- untangles problems of assembling complex wiring circuits
- prevents wiring errors
- cuts time required for production, quality control and maintenance
- reduces size and weight of end equipment
- costs less in quantity than conventional cable
- provides complete design freedom, lets you create new directions in electronics

If you would like to talk to one of our sales engineers and find out how Flexprint circuits can help solve *your* wiring problems, write to Sanders Associates, Inc., Flexprint Products Division, Nashua, New Hampshire, or call Area Code 603 TUxedo 3-3321.

FLEXPRINT PRODUCTS DIVISION  SANDERS ASSOCIATES, INC.

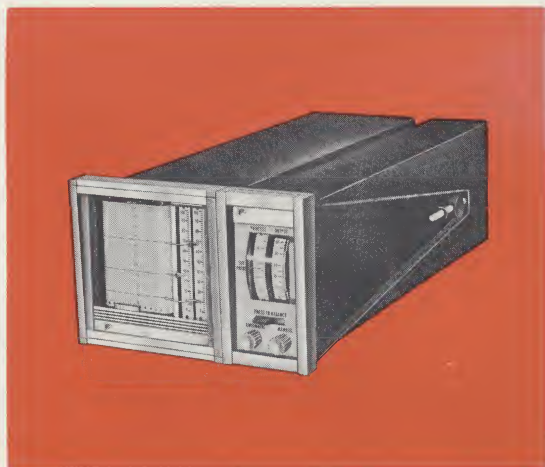
CREATING NEW DIRECTIONS IN ELECTRONICS

FLEXPRINT® ACCORDION

flexible printed circuitry

allows complete access to flush mounted instruments for inspection and routine maintenance. reliability was increased while cost was cut in half





THE APPLICATION

Two companion process control instruments manufactured by Fischer & Porter. Both units use similar FLEXPRINT ACCORDION cables to interconnect the fixed back panel terminal strip to the removable chassis printed circuit board. The accordion shape allows the chassis to be drawn completely out of 20" panel mounted case for inspection.

THE PROBLEM

The pre-prototype for each unit was designed with steel spring around the conventional 12 wire harness to coil it back into the case as chassis was inserted. The spring brought significant physical forces on the terminations that caused early failure of solder joints. The coiled cable was also too bulky. Flat cabling wound on a spring loaded reel was next used. This was easier to handle in servicing but still took considerable space in the case, and there was still a problem with cable tension contributing to the failure of solder joints.

A new design approach to the interconnection was indicated to increase field reliability and save space.

THE SOLUTION

Working in cooperation, the Fischer & Porter product design engineer and the FLEXPRINT Products Division engineers developed a FLEXPRINT accordion cable using 2 oz. (.0027") copper conductors encapsulated in thermoplastic film having good plastic memory.

The resulting cable has increased reliability of the interconnection to the point where it is no longer considered a factor. Its tension is carried by a strain relief bar at the back end and by an integrated strain relief device in the PC connector.

The space bonus provided by use of the FLEXPRINT accordion cable helped Fischer & Porter to add a third pen assembly to the recorder — **an increase in function of 50%** in the same space.

*PROCESS INSTRUMENT MANUFACTURER
INCREASES RELIABILITY AND FUNCTION
WITH COST REDUCING FLEXPRINT CIRCUITRY*



THE FLEXPRINT ACCORDION CABLE

FEATURES

1. Accordion developed in a cooperative effort between the Fischer & Porter Engineering Department and Sanders Associates FLEXPRINT Products Division Engineering Department. Note that it is not pressed to a sharp apex, but maintains at least a minimum radius of $\frac{3}{32}$ " at all times. It will also be noted that when under stretch that the straightening moments are distributed.
2. Saved 40% in installed cost.
3. FLEXPRINT ACCORDION saved enough space in package to allow 50% increase in function.
4. Increased reliability 100%.
5. Delivered ready to install, it is 100% factory inspected and tested for continuity and high potential dielectric resistance.
6. Assembly time approximately 11 minutes, one third the previous.
7. Eliminated wiring errors.
8. Gold plated contact areas factory produced and 100% perfect, ready to solder to a standard P.C. board connector.
9. Large "fanned out" dished solder pads to fit a standard Type "Y" barrier strip with $\frac{1}{8}$ " pins speeds soldering, increases reliability.

SPECIFICATIONS

Cable length, extended	Max. approx. 24"	Conductor size060"
Cable length, retracted	Approx. 1"	Conductor spacing040" min.
Cable thickness	Approx. .012	Volts	117 60 cycle
Cable width	Approx. 1 $\frac{3}{8}$ "	Power	30 watts
Plastic Insulation	5 mil. Fluorocarbon Film	Current	2 amps
Copper conductors	2 oz. rolled copper (.0027")	Specified Life Test	50,000 cycles

Twelve dished terminal pads with $\frac{1}{8}$ " diameter hole, to fit standard Type "Y" strip.

Conductors — $\frac{1}{16}$ " left bare at straight end and gold plated, formed to take a standard POS-E-KON connector.

Apexes of accordion are formed with a designed $\frac{1}{8}$ " diameter.



Fully retracted this FLEXPRINT accordion cable is less than 1" long . . . extended it is over 24" long.

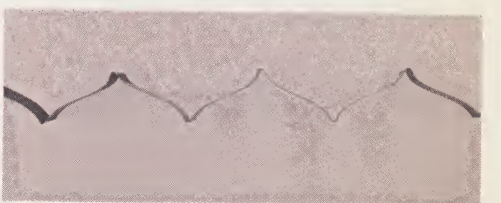
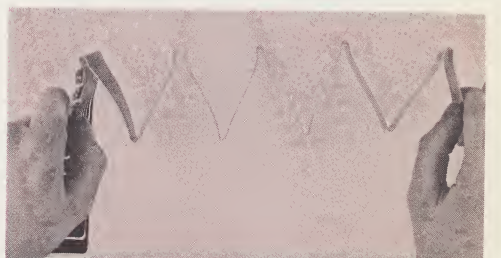
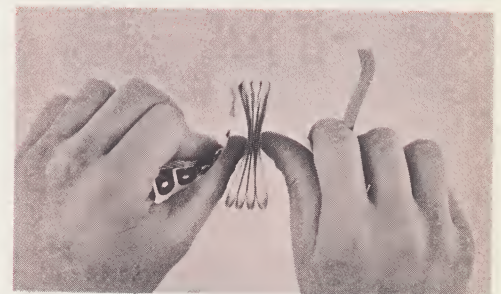
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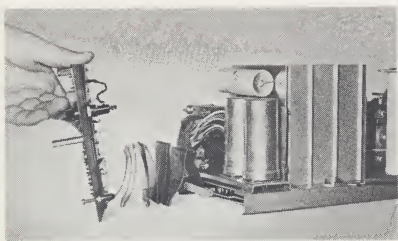
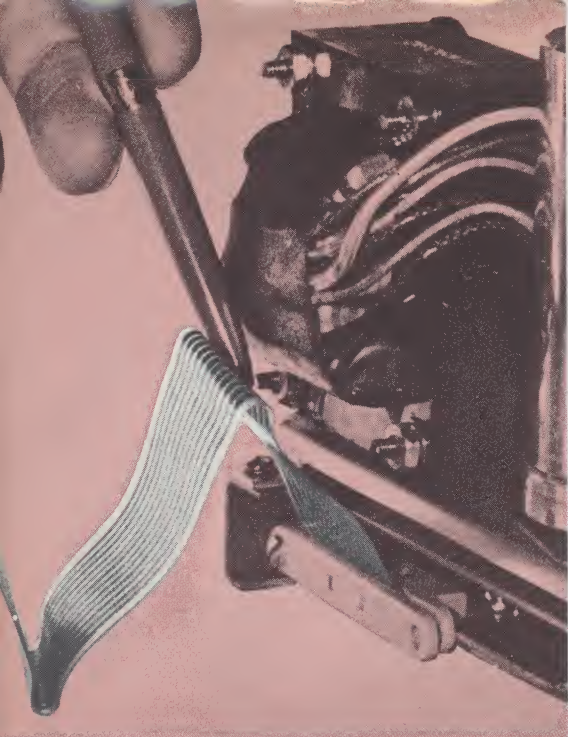
It is the only cable that can be retracted to a length of less than 1 inch and extended to a length of over 24 inches.

The FLEXPRINT accordion cable is a new development in the field of flexible cables. It is made of a special material that allows it to be retracted to a length of less than 1 inch and extended to a length of over 24 inches. This makes it ideal for use in applications where space is limited and flexibility is required.

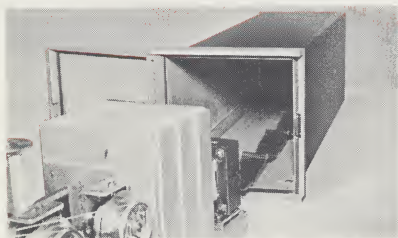
The FLEXPRINT accordion cable is available in a variety of lengths and configurations. It can be used in a wide range of applications, from simple signal transmission to complex data transfer. Its unique design allows it to be used in situations where other types of cables would be impractical.

For more information about the FLEXPRINT accordion cable, please contact our sales department. We will be happy to provide you with all the details you need to know.

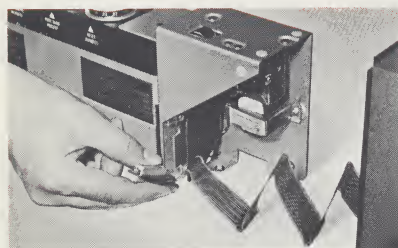




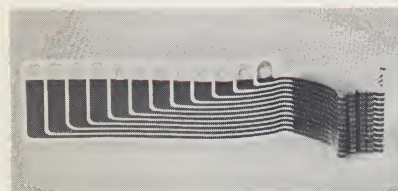
FLEXPRINT ACCORDION CABLE takes very little space when chassis is in operating position.



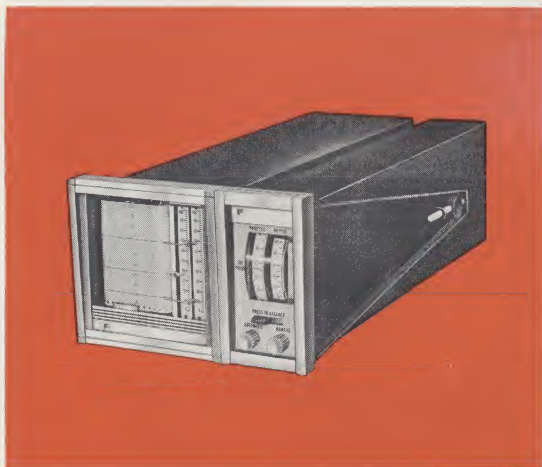
Chassis fully removed for inspection but still inter-connected to fixed back panel of case.



The PC connector is about to be pressed onto the Printed Circuit board. Note that it will be rotated through 90°. There is ample flexibility to allow considerable flexing and twisting.



Large terminal pads designed to fit a standard type "Y" barrier strip, easy to handle and solder.



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